How Sustainability and Fusion 360 Can Help You Save Money and the Planet

Chas Sullivan / Tyson Fogel
Sustainability Customer Engagement Manager / Shop Supervisor – ATC Toronto
About the speaker

Chas Sullivan

Sustainability Customer Engagement Manager at Autodesk, where he helps our Product Design and Manufacturing customers leverage technology to realize their sustainability and impact goals. Before joining Autodesk, Chas worked at Stratasys for eight years in various roles and most recently managed a team of application engineers who supported customers across automotive, aerospace, consumer products, industrial manufacturing, and entertainment industries. He has a background in Mechanical Engineering, specializing in additive manufacturing, manufacturing engineering, CAD tools, and sustainability. He’s a passionate gearhead and outdoor enthusiast, anything from restoring vintage sports cars/motorcycles to skiing the Alps.
About the speaker

Tyson Fogel

Shop Supervisor at Autodesk’s Toronto Technology Centre. Inspired by circularity and biomimicry, Tyson is an avid maker and sustainability advocate. He works directly with residents, innovation communities and researchers to provide technical expertise and fabrication consultation through the Autodesk Outsight Network. A designer and cabinet maker by trade, Tyson’s past work includes everything from additive, subtractive manufacturing, woodworking to CAD/CAM, Generative Design, construction and more recently - robotics.

Prior to Autodesk, Tyson worked at the University of Toronto as a Technician in their woodshop and at Ryerson University developing programs to support social entrepreneurs.
Autodesk recognized among the leaders
Leadership in sustainable business operations

Net-zero greenhouse gas emissions starting in FY21

Decreased greenhouse gas emissions by 43% since 2009. 31% of real estate is LEED®

Put a price on carbon into our financials.
Context
Artificial Intelligence

Simulation of human intelligence processes by machines
10B PEOPLE
75% URBAN DWELLERS
5B MIDDLE CLASS
2X ENERGY DEMAND
CO₂ Emitted Worldwide

Source: Oak Ridge National laboratory; Graph – New York Times
Global Emissions in GtCO₂

Peak x 2020
50% x 2030
Zero x 2050

Peak Emissions in 2020

50%

500 GtCO₂
(1.5°C, 50% Chance)

Source: Architecture 2030; Adapted from RealClimate.org “How much CO2 your country can still emit, in three simple steps”; and IPCC SR15, Table 2.2
So: Achieve the cut from Real Climate Change, or try:

A spot for CO₂ by year:

- Peak x 2020
- 50% x 2030
- Zero x 2050

500 GtCO₂
(1.5°C, 50% Chance)
CO₂ Emitted Worldwide

Source: Oak Ridge National Laboratory; Graph – New York Times

Emphasis on emissions reduction targets, with a focus on achieving 50% reduction by 2030 and reaching zero emissions by 2050.
URGENCY OF NOW
Industry Trends: Sustainability in D&M

MATERIAL PRODUCTIVITY & CIRCULARITY

ENERGY PRODUCTIVITY & ADVANCED MANUFACTURING

RESPONSIBLE SUPPLY CHAIN MANAGEMENT
Circularity

Maximizing value of resources by getting the most out of them

TRADITIONAL

Take → Make → Waste

CIRCULAR ECONOMY

Resources → Recycling → Manufacturing → Consumption & Use → Waste
DESIGN FOR A CIRCULAR ECONOMY

Circular design

Discover how to move to the circular economy. Learn how to reuse materials and produce less waste.

WATCH VIDEO

What is circular design?
How might we produce products with reduced negative impact while improving bottom line?
Solutions for Material Productivity
Material Productivity with Generative Design and NetFabb
Workflow Details

Generative Design
- Set goals and constraints
- Run on the cloud
- Explore results
- Optimize Print Process
- Simulate & Validate

NetFabb

Exploring options in Generative Design

Reducing support material with NetFabb
Reduce Material and Energy Use With Moldflow
Rheomold: Cutting scrap rate with Moldflow
Workflow Details

- **Moldflow Design**
  - See impact of design changes
- **Moldflow Insight**
  - Evaluate environmental indicators
  - Investigate design errors
- **Powershape and Moldflow Insight**
  - Increase throughput with conformal cooling
  - Simulate & Validate

**Environmental indicators in Moldflow Design**

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<th>Plastic material impact</th>
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**Conformal cooling analysis in Moldflow Insight**

- Conformal cooling analysis in Moldflow Insight
Solutions for Energy Productivity
Increase Energy Efficiency With CFD
Case Study: Opto 22
**Autodesk® CFD, Factory Design Utilities, Fusion 360®, Fusion Lifecycle, Inventor®, Moldflow®, Netfabb®, PowerMill®, and TruNest software**

### Material efficiency and circularity
- Improve materials efficiency, create lighter products, and reduce waste with generative design and composites
- Make greener materials choices
- Conduct simulations to test and design more durable products
- Nest pieces to optimize flat sheet cutting and reduce waste
- Pack products and use support material efficiently to reduce waste in additive manufacturing
- Improve print accuracy and success rate to decrease waste in additive manufacturing
- Minimize waste by repairing parts with hybrid manufacturing

### Energy efficiency and smart manufacturing
- Design and create energy-efficient electronics and machines
- Reduce energy use and waste in production by optimizing machine use and cooling cycles
- Analyze and optimize factory building energy consumption

### Responsible supply chain
- Audit suppliers to ensure product quality and compliance
- Increase quality through failure analysis and reports
- Comply with regulations with material and supplier declaration
Key features that unlock sustainability
Generative Design (GD)

Autodesk generative design is a design exploration technology. Simultaneously generate multiple CAD-ready solutions based on real-world manufacturing constraints and product performance requirements.

Generative Design is native to Fusion 360.
An GD Analogy

Using GD is like being a ‘farmer’ of design! Foster an environment for your designs to grow.

- The limitations and weather conditions are up to you
- GD output will only be as good as its environment
- You have filters to decide what plants will give you the best yield/results
GD & the Circular Economy

- Generative Design
- Sustainability
- Prototyping & Manufacturing

Data & Insight

Design for Manufacturing & Assembly

Design for Sustainability

Circular Economy
Topography Optimization

- Uses finite element method engine, to define which voxel is necessary for a certain load
- Removes material based on stress
- Typically obtains one solution
- Easy to find outside references

Generative Design

- Level Set Method to repeatedly calculate the minimum distortion parameters, moving the surface boundary
- Adds and removes material based on load conditions
- Can produce many solutions
- Less information out there to references
Sustainable Benefits to GD
Consolidation & Assembly
Light weighting
Ease of Manufacturing
Enhanced Performance & Quality
Product Development Process
Product Develop Process with GD
**Time & Resource Allocation**

**GD EXPECTATIONS**
Right click on the chart for an excel spreadsheet to populate your figures and automatically update this chart.

**GD REALITY**
Right click on the chart for an excel spreadsheet to populate your figures and automatically update this chart.
Show me more!
Sustainable Benefits of Simulation

- A high majority of manufacturing complications stem from a lack of operator/designer foresight.
- Simulation can give you this insight and the ability to adapt, improve, or address any inefficiencies.

Image courtesy of Briggs Automotive Company Ltd.
Opportunities

Generatively Design fixture workflow

GD + SIM + AM
Sustainable Benefits of Additive Manufacturing

- A high majority of manufacturing complications stem from a lack of operator/designer foresight.
- Simulation can give you this insight and the ability to adapt, improve or address any inefficiencies.
AM Pitfalls
AM Pitfalls

Sustainability

Material

Energy

Run Time

Preparation

Design for Additive Manufacturing
AM Solutions

1. Design for (dis)assembly
2. Infill Management
3. Support Structure Optimization
4. Packing
5. Generative Design
6. Simulation
7. Material Graduation
8. Prototype Fit, Form, Function & Post-Process
9. Capture in-machine data
10. Combine manufacturing processes
Orientation Optimization
Support Structure Optimization
Lattice Optimization
Packing
Nesting
The Future of Making
Starts Here

The Autodesk Technology Centers Outsite Network brings together pioneers innovating in design, architecture, engineering, construction, manufacturing, and emerging technologies.

Through this network, Autodesk helps bring solutions to life that enable people to do more and make better things with more positive impact on the world.
The Autodesk Technology Centers Outsight Network is a global community with resident teams from industry, academic, and entrepreneurial sectors coming together to create a shared vision of the future of making.

The program provides our residents access to a diverse and innovative community, subject matter expertise, and tools at no charge.
Autodesk Technology Centers

Our Technology Centers are equipped with state-of-the-art equipment and machinery to aid our residents as they prototype new ideas. Our facilities are available for use by all of our Outsight Network residents.

All our facilities offer:

**Inspiring workspaces**
- Desks and office amenities
- Project space for fabrication and assembly

**Advanced machinery**
- 3D Printing, CNC, Robotics
- Wood/Metal workshops, Electronics and more...

**Training and support**
- Expert Consultation
- Software and Equipment training

San Francisco, California  
Toronto, Ontario Canada  
Boston, Massachusetts
Join the Outsight Network

Connect

Our team is available to assist in proposal development and to answer questions.

Contact us at:

technology.centers@autodesk.com

Apply

Visit our website below to fill out a proposal form. We request that you provide us background on your team and your proposed project. Proposals are reviewed on a rolling basis.

Become a Resident

Once accepted, we will contact you to schedule an introductory meeting and work with you to ensure your team is well positioned for success.

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